

REMARKS

The present Supplemental Amendment amends claims 34 and 53, leaves claims 35-52 and 54-60 unchanged, and adds claims 61-62. Therefore, the present application has pending claims 34-62.

Interview Summary

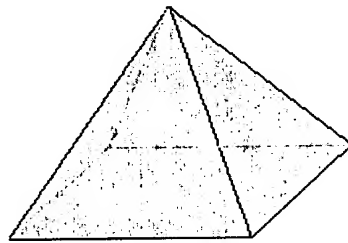
Applicants thank the Examiner for granting the interview conducted on March 20, 2007. In the interview, arguments were presented to overcome the cited references, particularly Wark and Ochiai. The Examiner indicated that further search and consideration would be required, and recommended filing a Supplemental Amendment to further amend the claims to more clearly distinguish the “pyramid-shaped” bump electrodes over the “pyramid-like” bump electrodes of Wark. In this response, Applicants have incorporated the Examiner’s recommendations into the claims.

35 U.S.C. §102 Rejections

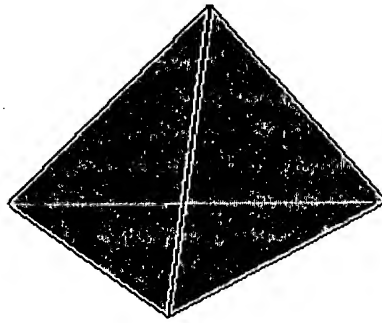
Claims 34-36, 38, 42, 44, and 54-60 stand rejected under 35 U.S.C. §102(e) as being unpatentable over U.S. Patent Application Publication No. 2001/0054771 to Wark, et al. (“Wark”). This rejection is traversed for the reasons included in the Amendment filed on March 2, 2007, and for the following reasons. Applicants submit that features of the present invention, as now more clearly recited in claims 34-36, 38, 42, 44, and 54-60, are not taught or suggested by Wark, whether taken individually or in combination with the other references of record. Therefore, Applicants respectfully request the Examiner to reconsider and withdraw this rejection

Further amendments were made to claim 34 to more clearly describe features of the present invention. Specifically, amendments were made to the claims to more clearly describe that the present invention is directed to a method of producing a semiconductor device as recited, for example, in independent claim 34.

One feature of the present invention, as recited in claim 34, includes where the pyramid-shaped bump electrodes have a shape of a pyramid, which is a figure having a square base and four triangle-shaped sides. Wark does not disclose this feature. As shown below, a pyramid is defined as a space figure having a square base and 4 triangle-shaped sides.



The present invention discloses the use of pyramid-shaped bump electrodes. Wark does not disclose the use of pyramid-shaped bump electrodes. To the contrary, and as shown in Fig. 1A (item 24), Fig. 2B (item 48) and Fig. 12 (item 510), Wark discloses the use of tetrahedron-shaped projections. As shown below, a tetrahedron is defined as a space figure having 4 sides, where each of the 4 sides is a triangle.



A pyramid-shaped bump electrode, as disclosed in the present invention, is not the same as a tetrahedron-shaped bump electrode, as disclosed in Wark.

Furthermore, a “triangular or pyramid-like” projection is not the same as a “pyramid-shaped” bump electrode. With reference to Fig. 1A, Wark describes the projections 24 as “triangular or pyramid-like” structures (paragraph [0042]). A triangular or pyramid-like structure is not the same as the actual shape of a pyramid, as in the present invention. To the contrary, a triangular or pyramid-like structure is an accurate description of the tetrahedron-shaped projections shown in Fig. 1A. In addition, it is clear that Wark intends to describe the projections 24 shown in Fig. 1A as triangular or pyramid-like based on the choice of language (i.e., “the projections 24, (here seen as radially extending, triangular or pyramid-like structures)) (paragraph [0042]).

In response to Applicants’ arguments, the Examiner contends that “Wark clearly teaches pyramidal-shaped bump electrodes of the semiconductor device,” citing Figs. 2A, 2B and 8D, and paragraph [0046]. However, Applicants respectfully disagree. Regarding Fig. 8D, this is clearly not a pyramid-shaped electrode because the base of the structure 204, as shown and described in the accompanying text, is a trapezoid — not a square base as in a pyramid-shaped electrode, as claimed.

Furthermore, regarding Figs. 2A and 2B, those figures must be considered together, within the context of the accompanying text at paragraph [0046]. For example, as clearly described in paragraph [0046], Figs. 2A and 2B illustrate where the contact structure 40 includes a plurality of knife-like projections 42, where the knife-like projections 42 are adjoined to form a frame-like receptacle for receiving a solder ball 44 there between. Neither of the knife-like projections, the solder ball, or the contact structure 40 has a square base having triangular sides, to form a pyramid-shaped bump electrode, as claimed. Therefore, Wark does not teach or suggest the claimed feature.

Therefore, Wark fails to teach or suggest “wherein the pyramid-shaped bump electrodes have a shape of a pyramid, which is a figure having a square base and four triangle-shaped sides” as recited in claim 34.

Therefore, Wark fails to teach or suggest the features of the present invention, as now more clearly recited in the claims. Accordingly, reconsideration and withdrawal of the 35 U.S.C. §102(e) rejection of claims 34-36, 38, 42, 44, and 54-60 are respectfully requested.

The remaining references of record have been studied. Applicants submit that they do not supply any of the deficiencies noted above with respect to the references used in the rejection of claims 34-36, 38, 42, 44, and 54-60.

35 U.S.C. §103 Rejections

Claims 37, 39-41, 43, and 45-53 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Wark in view of U.S. Patent No. 5,643,831 to Ochiai, et al. (“Ochiai”). Claims 37, 39-41, 43, and 45-52 are dependent on claim 34. Therefore,

Applicants submit that claims 37, 39-41, 43, and 45-52 are allowable for at least the same reasons as independent claim 34. Regarding the remaining claim 53, this rejection is traversed for the reasons provided in the Amendment filed on March 2, 2007, and for the following reasons. Applicants submit that the features of the present invention, as now more clearly recited in claim 53, is not taught or suggested by either Wark or Ochiai, whether taken individually or in combination with each other as suggested by the Examiner. Therefore, Applicants respectfully request the Examiner to reconsider and withdraw this rejection.

Further amendments were made to the claims to more clearly describe the features of the present invention. Specifically, the claims were amended to more clearly describe that the present invention is directed to a method of producing a semiconductor device as recited, for example, in independent claim 53.

One feature of the present invention, as recited in claim 53, includes where the pyramid-shaped bump electrodes have a shape of a pyramid, which is a figure having a square base and four triangle-shaped sides. As previously discussed, Wark does not disclose the use of pyramid-shaped bump electrodes. To the contrary, and as shown in Fig. 1A (item 24), Fig. 2B (item 48) and Fig. 12 (item 510), Wark discloses the use of tetrahedron-shaped projections. These tetrahedron-shaped projections are not the same as the pyramid-shaped bump electrodes of the present invention.

Therefore, Wark fails to teach or suggest "wherein the pyramid-shaped bump electrodes have a shape of a pyramid, which is a figure having a square base and four triangle-shaped sides" as recited in claim 53.

The above noted deficiencies of Wark are not supplied by any of the other references, particularly Ochiai. Therefore, combining the teaching of Ochiai with Wark still fails to teach or suggest the features of the present invention, as now more clearly recited in claim 53.

One feature of the present invention, as recited in claim 34, includes where the pyramid-shaped bump electrodes have a shape of a pyramid, which is a figure having a square base and four triangle-shaped sides. Ochiai does not disclose this feature. As shown and described, Ochiai discloses the formation of solder balls, which are quite different from the pyramid-shaped bump electrodes of the present invention.

Therefore, Ochiai fails to teach or suggest "wherein the pyramid-shaped bump electrodes have a shape of a pyramid, which is a figure having a square base and four triangle-shaped sides" as recited in claim 53.

Both Wark and Ochiai suffer from the same deficiencies relative to the features of the present invention, as recited in the claims. Therefore, combining the teachings of Wark and Ochiai, in the manner suggested by the Examiner, does not render obvious the features of the present invention, as now more clearly recited in claim 53. Accordingly, reconsideration and withdrawal of the 35 U.S.C. §103(a) rejection of claim 53 as being unpatentable over Wark in view of Ochiai is respectfully requested.

The remaining references of record have been studied. Applicants submit that they do not supply any of the deficiencies noted above with respect to the references used in the rejection of claim 53.

New claims 61 and 62

Claims 61 and 62 were added to more clearly describe features of the present invention. Applicants submit that independent claims 61 and 62 are similar to independent claims 34 and 53. However, new claims 61 and 62 are directed to "pyramidal bump electrodes" where the pyramidal bump electrodes have a shape of a figure including a rectangular base and at least two triangle-shaped sides. Wark in view of Ochiai does not teach or suggest this feature. Accordingly, claims 61 and 62 should be allowed.

In view of the foregoing amendments and remarks, Applicants submit that claims 34-62 are in condition for allowance. Accordingly, early allowance of claims 34-62 is respectfully requested.

To the extent necessary, Applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, or credit any overpayment of fees, to the deposit account of Mattingly, Stanger, Malur & Brundidge, P.C., Deposit Account No. 50-1417 (referencing attorney docket no. 500.38090X00).

Respectfully submitted,

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